

## **Amendments to the CLAIMS**

Please cancel Claims 1-12 and add new claims 13-26. No new matters are introduced.

1-12 (Canceled)

13. (New) A method for simulating structural responses of a rubber-like material in finite element analysis, the method comprising:

defining a plurality of elements and a strain-stress curve to represent the rubber-like material;

iteratively calculating a plurality of stress function  $f(\lambda_i)$  values at a plurality of corresponding stretch ratios  $\lambda_i$  of the rubber-like material and associated stress values  $\sigma(\lambda_i-1)$  defined in the strain-stress curve;

storing the plurality of stress function  $f(\lambda_i)$  values into a stress function lookup table;

obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements;

determining principal stresses in principal directions from the stress function lookup table in accordance with the principal stretches; and

transforming the principal stresses into global coordinate system.

14. (New) The method of claim 13, wherein the strain-stress curve is obtained from a physical experiment of the rubber-like material under a uni-axial loading condition.

15. (New) The method of claim 13, wherein the stretch ratio is a ratio between deformed length divided by original length of the rubber-like material in one direction.

16. (New) The method of claim 15, wherein the stretch ratio is equal to strain of the rubber-like material minus 1.

17. (New) The method of claim 13, wherein the strain has a range between -0.8 and 1.2.

18. (New) The method of claim 13, said iteratively calculating the plurality of stress function  $f(\lambda_i)$  values further includes:

(a) calculating a function value by multiplying an initial stretch ratio  $\lambda$  with the associated stress value at  $(\lambda-1)$ ;

(b) initializing an old stretch ratio  $\lambda_{old}$  with the initial stretch ratio  $\lambda$ ;

(c) calculating a new stretch ratio  $\lambda_{new}$  as an inverse of square root of the old stretch ratio  $\lambda_{old}$ ;

(d) when absolute value of  $(\lambda_{new}-1)$  is less than or equal to a predetermined threshold, assigning the function value to a particular one of the stress function values corresponding to the initial stretch ratio  $\lambda$

(e) otherwise,

adjusting the function value by adding another term, wherein another term is calculated by multiplying the new stretch ratio  $\lambda_{new}$  with the associated stress value at  $(\lambda_{new}-1)$ ;

assigning the new stretch ratio  $\lambda_{new}$  to the old stretch ratio  $\lambda_{old}$ ; and repeating (c), (d) and (e), until (d) has been satisfied.

19. (New) The method of claim 18, wherein the predetermined threshold is 0.01.

20. (New) The method of claim 13, said determining principal stresses in principal directions from the stress function lookup table further includes interpolating the stress function lookup table to obtain the principal stresses at the principal stretches.

21. (New) A computer program product including a computer usable medium having computer readable code embodied in the medium for causing an application module to execute on a computer for simulating structural responses of a rubber-like material, the computer program product comprising:

- program code for defining a plurality of elements and a strain-stress curve to represent the rubber-like material;

- program code for iteratively calculating a plurality of stress function  $f(\lambda_i)$  values at a plurality of corresponding stretch ratios  $\lambda_i$  of the rubber-like material and associated stress values  $\sigma(\lambda_i-1)$  defined in the strain-stress curve;

- program code for storing the plurality of stress function  $f(\lambda_i)$  values into a stress function lookup table;

- program code for obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements;

- program code for determining principal stresses in principal directions from the stress function lookup table in accordance with the principal stretches; and

- program code for transforming the principal stresses into global coordinate system.

22. (New) The computer program product of claim 21, said program code for iteratively calculating the plurality of stress function  $f(\lambda_i)$  values further includes:

- (a) program code for calculating a function value by multiplying an initial stretch ratio  $\lambda$  with the associated stress value at  $(\lambda-1)$ ;

- (b) program code for initializing an old stretch ratio  $\lambda_{old}$  with the initial stretch ratio  $\lambda$ ;
- (c) program code for calculating a new stretch ratio  $\lambda_{new}$  as an inverse of square root of the old stretch ratio  $\lambda_{old}$ ;
- (d) when absolute value of  $(\lambda_{new}-1)$  is less than or equal to a predetermined threshold, program code for assigning the function value to a particular one of the stress function values corresponding to the initial stretch ratio  $\lambda$
- (e) otherwise,
  - program code for adjusting the function value by adding another term, wherein another term is calculated by multiplying the new stretch ratio  $\lambda_{new}$  with the associated stress value at  $(\lambda_{new}-1)$ ;
  - program code for assigning the new stretch ratio  $\lambda_{new}$  to the old stretch ratio  $\lambda_{old}$ ; and program code for repeating (c), (d) and (e), until (d) has been satisfied.

23. (New) The computer program product of claim 21, said program code for determining principal stresses in principal directions from the stress function lookup table further includes program code for interpolating the stress function lookup table to obtain the principal stresses at the principal stretches.

24. (New) A system for simulating structural responses of a rubber-like material in finite element analysis, the system comprising:

- an I/O interface;
- a communication interface;
- a secondary memory;
- a main memory for storing computer readable code for an application module;
- at least one processor coupled to the main memory, the secondary memory, the I/O interface, and the communication interface, said at least one

processor executing the computer readable code in the main memory to cause the application module to perform operations of:

defining a plurality of elements and a strain-stress curve to represent the rubber-like material;

iteratively calculating a plurality of stress function  $f(\lambda_i)$  values at a plurality of corresponding stretch ratios  $\lambda_i$  of the rubber-like material and associated stress values  $\sigma(\lambda_i-1)$  defined in the strain-stress curve;

storing the plurality of stress function  $f(\lambda_i)$  values into a stress function lookup table;

obtaining a set of principal stretches by solving eigensolution of a deformation gradient tensor at each integration point of each of the elements;

determining principal stresses in principal directions from the stress function lookup table in accordance with the principal stretches; and

transforming the principal stresses into global coordinate system.

25. (New) The system of claim 24, said iteratively calculating the plurality of stress function  $f(\lambda_i)$  values further includes operations of:

(a) calculating a function value by multiplying an initial stretch ratio  $\lambda$  with the associated stress value at  $(\lambda-1)$ ;

(b) initializing an old stretch ratio  $\lambda_{old}$  with the initial stretch ratio  $\lambda$ ;

(c) calculating a new stretch ratio  $\lambda_{new}$  as an inverse of square root of the old stretch ratio  $\lambda_{old}$ ;

(d) when absolute value of  $(\lambda_{new}-1)$  is less than or equal to a predetermined threshold, assigning the function value to a particular one of the stress function values corresponding to the initial stretch ratio  $\lambda$

(e) otherwise,

adjusting the function value by adding another term, wherein another term is calculated by multiplying the new stretch ratio  $\lambda_{\text{new}}$  with the associated stress value at  $(\lambda_{\text{new}} - 1)$ ;

assigning the new stretch ratio  $\lambda_{\text{new}}$  to the old stretch ratio  $\lambda_{\text{old}}$ ; and  
repeating (c), (d) and (e), until (d) has been satisfied.

26. The system of claim 24, said determining principal stresses in principal directions from the stress function lookup table further includes operations of interpolating the stress function lookup table to obtain the principal stresses at the principal stretches.